URBAN AND ENVIRONMENTAL SERVICES PROJECT
Contract No. 608-C-00-96-00000

SUMMARIES OF PROPOSED TECHNICAL ASSISTANCE AND PILOT/BEST PRACTICES PROJECTS IN SOLID WASTE SYSTEMS

Prepared For:

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The Office of Environment and Urban Programs

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PROJECT SUMMARIES OVERVIEW

General

The various assessments of solid waste management systems in Meknes, Azrou, Sefrou and Oulad Teima have identified a variety of deficiencies. One of the goals of the Urban and Environmental Services Project is to improve the provision of environmental services through technical assistance or pilot/best practices projects. As a result of previous assessments, eight project topics are presented herein for consideration. Three of the projects are listed as technical assistance projects which are continuations of the previous studies in the four target municipalities. In addition to the three technical assistance projects, five other projects are presented as potential pilot/best practices projects. These projects are as follows:

Technical Assistance Projects

1. Landfill operations in Azrou and Oulad Teima and Operator training.
2. Landfill Privatization in Meknes
3. Collection Privatization in Meknes

Pilot / Best Practices Projects

1. Recycling
2. Composting
3. Composting / Water Re-Use
4. Containerized Collection
5. Medical Waste

Each of the eight projects is presented in more detail in the following pages. Most of the projects will require a Feasibility / Program Design phase, before the full project can be identified and cost estimates prepared. These descriptions are intended for review and input by USAID, National Government Ministries, FEC, and the municipalities involved. After the selection of projects to be implemented is made, a detailed scope of work will be prepared for each project.

PROJECT NAME: **LANDFILL OPERATING PLANS / WORKSHOP**

PROJECT TYPE: **TECHNICAL ASSISTANCE**

LOCATION: **AZROU / OULAD TEIMA**

Description:

The Azrou landfill is out-of-control and in need of an operating plan. The plan should outline the tasks necessary to clean up the existing site and convert it to a controlled landfill. During the last TDY, the Azrou technical staff expressed a lot of interest in an operating plan. They will start by doing a topographic survey of the site and prepare a site map. Once those items are completed, the operating plan can be prepared and included in an operating manual. This manual would be set up to include general operating procedures and those which are specific to Azrou. Therefore, the manual could be used in another municipality with some minor changes.

Oulad Teima also needs an operating plan. Unlike Azrou, Oulad Teima will be a new landfill. Initial construction, siting issues and litter control will be stressed. The plan will provide a 20-year plan for site development including office and depot facilities, an area for processing recyclables and areas for handling special wastes such as medical waste and abattoir wastes. Due to the daily high winds experienced in Oulad Teima, the operating plan will stress litter control and buffer areas designed to block high winds and catch wind blown debris.

At the present time both landfills are relatively small and may not require full time equipment for waste compaction and covering. This is a good opportunity to contract with the private sector for weekly or bi-weekly compaction and covering.

Closure plans will be developed for both landfills. This will include a final topographic map and other geographical features of the site conforming to the post closure use selected by the municipality.

The operating plans will be prepared so that they can be integrated into a landfill operator training program for small and medium sized municipalities, to be held at a later date.

Level of Effort:	International Solid Waste Consultant	25 days
	Local Consultant	15 days
Local Coordination:	Ministry of the Environment	
	Ministry of the Interior	
	Participating Municipalities	

PROJECT NAME: **LANDFILL PRIVATIZATION FEASIBILITY STUDY**

PROJECT TYPE: **TECHNICAL ASSISTANCE**

LOCATION: **MEKNES**

Description:

Previous studies have documented the need for a new landfill in Meknes and assisted the City in locating a new landfill site. At the present time, the City is negotiating with the local municipality and the governor's office for permission to utilize the site.

The City has expressed a desire to privatize the construction and operation of the landfill. Although there are many impediments to privatization of public services in Morocco, a feasibility study is needed to define these impediments and offer solutions so that privatization can move forward.

The Feasibility Study would include a definition of services, cost estimates (public and private), legal issues, contracting issues, available private resources, regulations, payment guarantees and financing mechanisms. The feasibility study would also include draft tender documents for landfill construction and operation.

The Feasibility Study could also be coordinated with a pilot project to improve municipal financing. The new landfill will require additional funds for construction and operation. Increased collection of existing taxes, improved revenue generation and potential new revenue sources need to be evaluated.

Level of Effort:	Foreign solid waste consultant	20 days
	Local Engineering consultant	15 days
	Local Legal Consultant	15 days
Local Coordination:		
	Ministry of the Environment	
	Ministry of Interior	
	Meknes Urban Community	
	Meknes Municipalities	
	FEC	

PROJECT NAME: **PRIVATE COLLECTION FEASIBILITY STUDY**

PROJECT TYPE: **TECHNICAL ASSISTANCE**

LOCATION: **MEKNES**

Description:

In addition to privatizing their landfill, the Meknes Urban Community and municipalities also want to privatize all waste collection. The privatization of all of the city is not recommended at this time. A portion of the City, perhaps one or two of the six municipalities, should evaluate and implement private collection. If successful, the other municipalities could privatize, through an expansion of the existing contract or separate new contracts.

The private sector can be more efficient in the use of equipment and manpower. These efficiencies are in part due to economies of scale which result from large collection companies specializing in waste collection. As a minimum, the feasibility study should define a collection pilot area equivalent to a two-truck operation.

The private sector will make a significant investment in specialized trucks, containers and other resources. In general they will need a guarantee of payment and a long enough contract term to capitalize this equipment, at least 3 to 5 years. At the present time, municipalities and Urban Communities are not permitted to sign long term contracts. The existing legal system is also inefficient and may not have the resources to act appropriately to a contractor claim of non-payment. These are significant issues which must be researched and addressed during the Feasibility Study. Without some form of payment guarantees privatization is not likely to succeed.

Level of Effort:	Foreign solid waste consultant	20 days
	Local Engineering consultant	15 days
	Local Legal Consultant	15 days
Local Coordination:		
	Ministry of the Environment	
	Ministry of Interior	
	Meknes Urban Community	
	Meknes Municipalities	
	FEC	

PROJECT NAME: RECYCLING

PROJECT TYPE: PILOT PROJECT

LOCATION: TO BE DETERMINED

Description:

In all four target municipalities, recycling is occurring within the informal sector. Observations were also made in other municipalities, including Rabat and Agadir. The amount of recycling varies based on the availability of markets and the system for transporting materials. Materials being recycled included plastic bottles, paper and metal.

Based on limited information, recycling occurs at three points in the system. Initial recycling begins with scavengers who remove materials from containers or waste piles on the street before collection. This system is very active in Rabat, where scavengers with handcarts can be seen, usually in the afternoon and evening. The second level occurs on the collection trucks. Collection workers remove materials as they are collecting the waste. Materials are placed in sacks, boxes or wherever convenient on the collection truck. This level of recycling is very active in Meknes and Agadir. In some cases, each worker on the truck had his own material sacks, so that the trucks had as many as 15 individual sacks holding materials. This second level of recycling obviously impacts collection efficiency.

The third level of recycling is at the landfill. Materials are removed from waste that is dumped in the landfill, by scavengers who work in very poor conditions at considerable risk. Many of the people live at the landfill or in nearby shanty towns. In the larger landfills such as Meknes, these scavengers are a major problem and hinder proper landfill operation. The recovered materials are obviously dirty and of a lower quality than those removed earlier in the system. Plastic bottles recycled from the landfill yield a lower price because they must be washed before the market will accept them. Due to the negative impacts of having recycling occur at the landfill, it is desirable to shift recycling toward the generation and collection end of the system and away from the landfill.

After the initial removal of the materials, they are sold and processed through a series of processors. This is the least understood aspect of the system. We know that paper and cardboard are baled by hand and transported to markets, some at a considerable distance. Meknes is fortunate to have two paper mills and transport distance is short. In Agadir, the paper is shipped via truck to Kenitra, a distance of 650 km.

Material prices are surprisingly high. The paper mills in Meknes pays .65 to 1.0 DH per kg for cardboard depending on quality. The upper price is equivalent to $107/ton. In the United States, the current average price is about $30/ ton. Plastics, primarily PVC, bring about 1.6 DH per kg or $172 per ton. Prices in the United States vary from $80 to $360 per ton depending on the type of plastic. Primary markets exist in Casablanca and several other cities. Plastic bottles are shipped loose in large sacks, which is a very inefficient.

Although previous evaluations have not concentrated on recycling, minimal observations indicate that the recycling systems are informal and inefficient but also represents a significant resource in material values. A pilot project is recommended that would better define the current informal recycling system and offer guidance to the public or private sector to improve the system. The goals of this project should include:

1. Increase the amount of recycled materials removed from the landfill.
2. Shift the recycling toward the generation/collection system and away from the landfill.
3. Increase public revenues from recycled materials.
4. Improve transportation efficiencies
5. Improve economic and health conditions

The project would be divided into a Feasibility / Program Design phase and an Implementation phase. Since previous work has not focused on recycling, the Feasibility / Program Design phase is needed to define the existing situation. After selecting the target municipalities to participate, the existing informal system will be fully defined, including numbers of scavengers involved, volume estimates of recycled materials, intermediate processors, prices paid to scavengers, processing and transport systems, end markets and prices paid by end markets.

After defining the existing situation, the pilot program can then be defined and implemented. Based on preliminary findings, the pilot program could include but not limited to the following:

1. Recycling Handbook:

The handbook would include a description of the materials currently being recycled, their end markets, and current markets prices. Methods of organizing a public recycling program would be included plus estimated system costs and projected revenues.

2. Pilot Project

Select one municipality to implement a public recycling program. This would most likely include improved source separation and collection of recyclables and a small sorting and processing facility at the landfill. The objective would be to remove as much material as possible so that recycling at the landfill would not occur.

Level of Effort:

1. Feasibility/Program Design

International Solid Waste consultant	15 Days
Local Moroccan Consultant	15 Days

2. Pilot Project	(To be determined in Feasibility/Program Design)
Local Coordination:	Ministry of the Environment Ministry of the Interior Municipalities FEC

PROJECT NAME: COMPOSTING

PROJECT TYPE: PILOT PROJECT

LOCATION: OULAD TEIMA

Description:

Since the 1970's, there have been 6 compost facilities built in Morocco, all of which have either failed or are experiencing significant technical of financial problems. In general these have been large plants with mechanical processing equipment, developed, designed or financed by foreign aid organizations. The latest plant in Agadir (10 months old) is a prime example of the problems. It relies very heavily of mechanical means to process and separate materials. At the present time the plant is still in a testing phase but our inspection in June found several key problems, dealing with technical process control and the lack of a market for the finished compost. Initial plans are to produce rough unscreened compost to cover the existing landfill, then install a screening plant and sell agricultural compost. Agricultural markets have not been located to date.

Composting is a specialized process requiring a good understanding of the materials being composted and the composting process. Composting is gaining in popularity in the United States and Europe. The driving force behind this trend in the increasing cost of landfilling. In Morocco, conditions are very good for landfilling as the prime waste disposal process and landfill costs should remain low, well below the cost of producing compost, especially in the large mechanical plants such as in Agadir. The same conditions that favor landfilling, dry climate and heavy soils, also make compost a valuable product. The goal should be to find a cost effective compost process that results in costs similar if not less than landfilling and low enough to attract a global agricultural market. The current highly mechanical plants have not found a cost effective balance.

A pilot compost project is recommended that will produce a high quality compost at an affordable price. Secondary goals will be to establish process operating standards that can be applied to other plants such as Agadir. The pilot project is recommended for Oulad Teima because of its regional agricultural market. Initially , the project would use only vegetable waste from the market and paunch waste from the abattoir. These will produce a low carbon to nitrogen ratio (C/N ratio) so a source of high carbon must also be located. Chaff from wheat or other grains would be a good carbon source. The proper C/N ratio is essential for producing compost in a reasonable time frame and to control of odors. The proper C/N ratio is one of the process problems at the Agadir facility.

A Feasibility Study / Program Design phase is recommended to inventory the wastes available for composting, locate a site, design the program and evaluate private sector interest in operating such a facility. The facility will require water to keep the compost piles moist, so the site should be near the agricultural zone with access to irrigation water, and not at the proposed landfill site.

The pilot facility should also include test beds for growing several crops that are common in the region. Beds with and without compost should be grown to demonstrate the advantages of compost amended soils.

This pilot project could also include an evaluation and recommendations for operating the Agadir facility. This facility clearly has some design and operating flaws which need revision. The Agadir compost could also be used in the test beds in Oulad Teima which will benefit the efforts to find large agricultural markets.

Level of Effort:

1. Feasibility / Program Design Phase

International Solid Waste / Compost Consultant	20 days
Local Consultant	15 days

2. Pilot Program (to be determined in Feasibility / Program Design)

Local Coordination:
- Ministry of the Environment
- Ministry of the Interior
- Ministry of Agriculture
- Municipality of Oulad Teima
- Municipality of Agadir
- Local Farmers
- FEC

PROJECT NAME: **COMPOST / WASTE WATER RE-USE**

PROJECT TYPE: **PILOT PROJECT**

WHERE: **OULAD TEIMA**

Description:

This pilot project would integrate a wastewater re-use pilot project with a solid waste compost project. The emphasis of the project would be on agricultural use of compost and re-use of wastewater for irrigation. The existing Oulad Teima wastewater is piped to a point approximately 2 km north of the city. From there it travels in a small channel for about 3 kilometers before discharging to the River Sous. The area on either side of this channel is lush with green vegetation and parts of the channel have developed into a wetland or marsh. The channel was inspected in June during the solid waste evaluation at the point where the channel crosses a large irrigation pipeline. A few aquatic animals were living in the wastewater channels, indicating that a limited degree of natural treatment was already occurring from the wetland vegetation growing along this channel. This is a unique situation and offers an excellent opportunity for a pilot project.

A pilot project is recommended that would evaluate artificial wetlands as a full scale treatment process for Oulad Teima. Initial Feasibility / Program Design activities would include an assessment of the existing channel and definition the existing treatment levels due to the existing green channel. Initial activities would also include measurement of existing flows, both dry and wet weather, and an inventory land and agricultural activities along the existing 3 kilometer channel. The inventory would include land ownership, crops grown, soil types and irrigation methods.

The actual pilot project would be based on the results of the Feasibility / Program Design phase. A diversion structure would be located at some point along the existing channel, with a percentage of flow diverted to a wetland pilot plant. This would consist of manufactured beds containing various plant species. The beds could be preceded by lagoon or other passive natural treatment component, depending on the strength of the wastewater and the point along the channel where it is withdrawn.

The compost portion of the pilot project would include the use of land near the wastewater channel with poor soils, lacking in sufficient organic matter. Several test plots would be located and treated with compost made either from the pilot compost plant in Oulad Teima or the existing facility in Agadir. Crops would be selected and monitored over several growing seasons, measuring yields, water required, heavy metal concentrations and other variable parameters identified in the Feasibility / Program Design phase. At least one plot should be irrigated with wastewater effluent from the wetland pilot project.

Depending on the results of the Feasibility / Program Design phase the pilot project could also include alterations to the existing wastewater channel, increasing the existing wetland treatment potential.

The Feasibility / Program Design phase will also evaluate administrative options for the pilot program. Hopefully some of the private growers along the channel will be interested in participating in the program. A strict quality control program would be required to insure that food crops are not contaminated.

Level of Effort:

1. Feasibility / Program Design

Foreign wastewater consultant	25 days
Foreign solid waste/compost consultant	15 days
Local consultant	25 days

2. Pilot Project (To be determined in Feasibility / Program Design)

Local Coordination:
Ministry of the Environment
Ministry of the Interior
Ministry of Agriculture
Municipality of Oulad Teima
Municipality of Agadir
Local Farmers
FEC

PROJECT NAME: CONTAINERIZED COLLECTION

PROJECT TYPE: PILOT PROJECT

LOCATION: OULAD TEIMA

Description:

The new national solid waste guidelines emphasize the inefficient use of daily curbside collection of solid waste in urban cities. The guidelines present documentation that costs could be reduced by 20 to 30 percent by converting to a containerized collection system, with collection frequency reduced to 3 times per week. They have suggested a five-year goal to convert all urban collection to 3 times per week with containers.

Although most of the larger cities have already begun converting to containers, few if any of the small to medium sized municipalities have begun using containers. None of the four study municipalities are using containers.

Oulad Teima is the best municipality in the study group to evaluate containerized service. The municipality has eliminated most of its shanty town development, replacing them with 2 and 3-story multiple housing buildings. The new street pattern is a well designed grid system that will assist in waste collection using containers and larger compaction trucks. There are adequate locations for containers. The existing system uses primarily curbside collection with manually loaded trucks. One Multi-Benne truck services 6 large containers.

A Feasibility Study would define existing costs and define an area of the municipality to participate in the pilot program. The Feasibility Study would also design the containerized collection system and estimate its costs of operation. Since the use of compaction truck is most efficient when they are fully utilized, the pilot area may include the entire municipality. The containerized system could be operated by the municipality or by the private sector. Due to Oulad Teima's regional agricultural nature there are many trucking companies that have the ability to operate a collection truck. If FEC funding is used, the system must be publicly operated, because FEC will not loan money for privatization.

Implementation would include the purchase of a large 16 to 18 m^3 collection truck and enough containers to cover the pilot area. The number of containers and their placement will be determined in the Feasibility Study. A new accounting system would be implemented to maintain an accurate, separate record of collection costs that can be compared to the estimated costs of daily curbside collection. An important part of the implementation program will be public participation. This will be a major change in their daily routine and a comprehensive public education program will be necessary.

Level of Effort:

1. Feasibility Study

Foreign solid waste consultant	20 days
Local consultant	15 days

2. Pilot Program (To be determined)

Local Coordination: Ministry of the Environment
Ministry of the Interior
Municipality of Oulad Teima
FEC

PROJECT NAME: MEDICAL WASTE MANAGEMENT

PROJECT TYPE: PILOT PROJECT

LOCATION: CITY TO BE DETERMINED

Description

All four target cities have a problem with medical waste mixed with other solid waste. There is no disinfection or special handling for medical waste and it is a significant health risk to municipal collection workers and scavengers at the landfill. This is not a new topic in Morocco. The new National Guidelines include an entire volume on infectious waste. The guidelines list reports, studies, workshops, committees , etc., dating from 1982 to the present, that have addressed the problem, but nothing has been implemented. For the most part, these have been "top-down" approaches which have not gotten to the local level for implementation. Although there is a need for national policies and regulations as called for in the new guidelines, there is also a need to begin something.

In this Pilot Project we propose a bottom-up approach. First a local hospital in one of the municipalities should be selected for participation. They must agree to participate and assign one full-time person to the position of "infectious waste manager". A similar sized hospital in the United States would then be selected to be a "twin" hospital to the Moroccan hospital. This would be similar to the popular USAID twin cities program. The US hospital must agree to allow its "infectious waste manager" to travel to Morocco for a 2-week period to train the Moroccan manager and hospital staff. After an 8 week period, the US manager would return to Morocco, evaluate the program and prepare a written report. The program could also include a trip to the US by the Moroccan manager. The final report would take the form of a handbook, which could be used by other hospitals.

The project should also include budget for a 1-year supply of color coded plastic bags for waste separation and containers for sharps disposal, educational materials etc. If possible, the budget could also include funds for one or several autoclaves for waste disinfection or an incinerator, if a larger hospital is selected. The best hospital would be Meknes because of its size and potential regional nature with Azrou and Sefrou.

This project could have several optional tasks. One of these tasks could be the design and operation of an infectious waste incinerator using local components.

Level of Effort:	US infectious waste consultant	4 weeks
	Equipment/Supplies:	Colored Bags, Autoclave, and incinerator
Local Coordination:	Ministry of Health	
	Ministry of Interior	
	Ministry of the Environmental	

Local Hospital